E/ECE/324
E/ECE/TRANS/505 } Rev.1/Add.48/Rev.2/Amend.2

5 March 1997

AGREEMENT

CONCERNING THE ADOPTION OF UNIFORM TECHNICAL PRESCRIPTIONS FOR WHEELED VEHICLES, EQUIPMENT AND PARTS WHICH CAN BE FITTED AND/OR BE USED ON WHEELED VEHICLES AND THE CONDITIONS FOR RECIPROCAL RECOGNITION OF APPROVALS GRANTED ON THE BASIS OF THESE PRESCRIPTIONS*/

(Revision 2, including the amendments entered into force on 16 October 1995)

Addendum 48: Regulation No. 49

Revision 2 - Amendment 2

Supplement 2 to the 02 series of amendments - Date of entry into force: 28 August 1996

UNIFORM PROVISIONS CONCERNING THE APPROVAL OF COMPRESSION-IGNITION (C.I.) AND NATURAL GAS (N.G.) ENGINES AS WELL AS POSITIVE-IGNITION (P.I.) ENGINES FUELLED WITH LIQUEFIED PETROLEUM GAS (LPG) AND VEHICLES EQUIPPED WITH C.I. AND N.G. ENGINES AND P.I. ENGINES FUELLED WITH LPG, WITH REGARD TO THE EMISSIONS OF POLLUTANTS BY THE ENGINE

UNITED NATIONS

---

*/ Former title of the Agreement:

Agreement Concerning the Adoption of Uniform Conditions of Approval and Reciprocal Recognition of Approval for Motor Vehicle Equipment and Parts, done at Geneva on 20 March 1958

GE.97-20557

Title of the Regulation, amend to read: (see cover page)

Text of the Regulation

Paragraph 1, amend to read:

"1. SCOPE

This Regulation applies to the emission of gaseous and particulate pollutants from C.I. and N.G. engines and P.I. engines fuelled with LPG, used for driving motor vehicles having a design speed ...."

Footnote 2/ pertinent to paragraph 1, amend to read:

"2/ Engines used by category N1, N2, and M2 ...."

Paragraph 2.7. (former para. 2.6., see document TRANS/WP.29/R.700), amend to read:

"2.7. "gaseous pollutants" means carbon monoxide, hydrocarbons (assuming a ratio of $C_1H_{1.85}$ for C.I. engines, $C_1H_{3.76}$ for N.G. engines and $C_1H_{2.61}$ for LPG engines) and oxides of nitrogen, the last named being expressed in nitrogen dioxide (NO_2) equivalent."

Paragraph 2.10. (former para. 2.9, see document TRANS/WP.29/R.700), amend to read:

"2.10. "rated speed" means the maximum full load speed allowed by the governor as specified by the manufacturer in his sales and service literature, or, if such a governor is not present, the speed at which the maximum power is obtained from the engine, as specified by the manufacturer in his sales and service literature."

Annex 1, "ESSENTIAL CHARACTERISTICS OF THE ENGINE AND INFORMATION CONCERNING THE CONDUCT OF TEST"

Insert new items 3.4. to 3.4.6.5., to read:

"3.4. For LPG-fuelled engines: . . . . . .
3.4.1. Evaporator/pressure regulator: . . . . . .
3.4.1.1. Make(s): . . . . . .
3.4.1.2. Type(s): . . . . . .
3.4.1.3. Certification number: . . . . . .
3.4.1.4. Identification: . . . . . .
3.4.1.5. Drawings: . . . . . .
3.4.1.6. Number of main adjustment points: . . . . . .
3.4.1.7. Description of principle of adjustment through main adjustment points: . . . . . .
3.4.1.8. Number of idle adjustment points: . . . . . .

3.4.1.9. Description of principles of adjustment through idle adjustment points: . . . . . .

3.4.1.10. Other adjustment possibilities (if so and which): . . . . . .

3.4.2. By LPG carburation equipment: yes/no 1/

3.4.2.1. System description: . . . . . .

3.4.2.1.1. Make(s): . . . . . .

3.4.2.1.2. Type(s): . . . . . .

3.4.3. Mixing piece: yes/no 1/ . . . . . .

3.4.3.1. Number: . . . . . .

3.4.3.2. Make(s): . . . . . .

3.4.3.3. Identification: . . . . . .

3.4.3.4. Drawings: . . . . . .

3.4.3.5. Place of installation: . . . . . .

3.4.3.6. Adjustment possibilities: . . . . . .

3.4.4. By injection equipment: yes/no 1/

3.4.4.1. Number: . . . . . .

3.4.4.2. Make(s): . . . . . .

3.4.4.3. Identification: . . . . . .

3.4.4.4. Drawings: . . . . . .

3.4.4.5. Place of installation: . . . . . .

3.4.4.6. Adjustment possibilities: . . . . . .

3.4.4.7. Injector(s) : yes/no 1/ . . . . . .

3.4.4.7.1. Make(s): . . . . . .

3.4.4.7.2. Type(s): . . . . . .

3.4.4.7.3. Identification: . . . . . .

3.4.5. Electronic Control Unit LPG-fuelling:

3.4.5.1. Make(s): . . . . . .

3.4.5.2. Identification: . . . . . .

3.4.5.3. Adjustment possibilities: . . . . . .

3.4.6. Further documentation: . . . . . .

3.4.6.1. Description of the LPG-equipment and the physical safeguarding of the catalyst at switch-over from petrol to LPG or back: . . . . . .

3.4.6.2. System lay-out (electrical connections, vacuum connections, compensation hoses, etc.): . . . . . .

3.4.6.3. Drawing of the symbol: . . . . . .

3.4.6.4. Adjustment data: . . . . . .

3.4.6.5. Certificate of the vehicle on petrol, if already granted: . . . . . "

Annex 2A, "COMMUNICATION", amend the title to read:

"....
of a compression-ignition (C.I.) engine type / of a natural gas (N.G.) engine type 2/ or a positive-ignition (P.I.), LPG-fuelled engine type 2/, as a separate technical unit with regard ...."

Insert new items 3 and 3.1., to read:

"3. Combustion type: compression-ignition/positive-ignition 2/

3.1. Type of fuel: . . . . . "

Items 3 to 18 (former), renumber as items 4 to 19.

Annex 4, TEST PROCEDURE", insert a new paragraph 3.1., to read:

"3.1. In the case of LPG, the fuel shall be of commercial quality, of which density and heating value shall be determined and noted in the report."

Annex 4 - Appendix 1,

Insert a new paragraph 2.2.2.3., to read:

"2.2.2.3. In the case of LPG-fuelled engines:

$V'_{EXH} = V''_{AIR} - G_{FUEL}$ (dry exhaust volume)

or

$V''_{EXH} = V''_{AIR} + G_{FUEL}$ (wet exhaust volume)"

Annex 4 - Appendix 3,

Insert a new paragraph 1.1.2.1.3., to read:

"1.1.2.1.3. In the case of LPG-fuelled engines:

ppm (wet basis) = ppm (dry basis) x $(1-2.40\ G_{FUEL}/G_{AIR})$

where:

G_{FUEL} is the fuel flow (kg/s) (kg/h)
G_{AIR} is the air flow (kg/s) (kg/h) (dry air)"

Insert a new paragraph 1.1.6., to read:

"1.1.6. The pollutant mass flow for LPG-fuelled engine and for mode, shall be calculated as follows:

(1) NO_x mass = 0.001587 x NO_x conc x G_{EXH}

(2) CO_{mass} = 0.000966 x CO_{conc} x G_{EXH}

(3) HC_{mass} = 0.000505 x HC_{conc} x G_{EXH}

or,

(1) NO_x mass = 0.00205 x NO_x conc x V'_{EXH} (dry)

(2) NO_x mass = 0.00205 x NO_x conc x V''_{EXH} (wet)

(3) CO_{mass} = 0.00125 x CO_{conc} x V'_{EXH} (dry)

(4) HC_{mass} = 0.000653 x HC_{conc} x V''_{EXH} (wet)"

Paragraph 1.1.6. (former -see document TRANS/WP.29/R.700), renumber as paragraph 1.1.7.

Paragraph 1.3.3., amend to read:

"1.3.3. Total sampling type with CO_2 measurement and carbon balance method

$$G_{EDF,i} = \frac{206 \times G_{FUEL,i}}{CO_{2D,i} - CO_{2A,i}} \qquad (C.I.\ engines)$$

or,

$$G_{EDF,i} = \frac{195 \times G_{FUEL,i}}{CO_{2D,i} - CO_{2A,i}} \qquad (LPG\text{-}fuelled\ engines)$$

where:

....."

Annex 4 - Appendix 4, paragraph 1, insert a reference to footnote 1/, and a new footnote 1/, to read:

"1/ In the case of LPG-fuelled engines, unheated sample lines and instruments are acceptable for the measurement of HC and NO_x."